Organic geochemistry of the Boltysh impact crater, Ukraine

Conference or Workshop Item

ORGANIC GEOCHEMISTRY OF THE BOLTYSH IMPACT CRATER, UKRAINE

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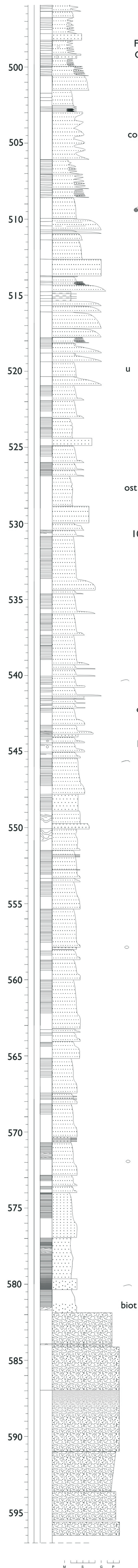

Figure 3 :Sedimentary log of bottom 100 m of Boltysh core.

INTRODUCTION

The Boltysh crater has been known for several decades and was first drilled in the 1960s as part of a study of economic oil shale deposits. Unfortunately, the cores were not curated and have been lost. We have re-drilled the impact crater and have recovered a near continuous record of ~400 m of organic-rich sediments together with 15 m of suevite. The sediments were deposited in a deep isolated lake and span a period of only ~1 Ma.

The Boltysh impact crater, centred at 48°54'N and 32°15'E, is a complex impact structure formed on the crystalline basement rocks of the Ukrainian shield, which comprise porphyroblastic granites (age ca. 1.55 Ga) and biotite gneissses (age ca. 1.85 – 2.22 Ga) [1]. The structure is covered by Quaternary sediments and has been dated at 65.17±0.64 Ma [2]. At 24km diameter, the impact is unlikely to have contributed substantially to the worldwide devastation at the end of the Cretaceous.

PRELIMINARY RESULTS

The lowermost 15m of the core is predominantly a polymict suevite breccia with evidence of secondary hydrothermal activity (Figure 2a). A sharp. 60°, angular contact marks the boundary between the impact breccia and the overlying sedimentary deposits (Figure 2b). The first sediments to be deposited in the crater lake occur at 581.5m and comprise a series of thin turbidite beds overlain by progressively more organic-rich shales (Figure 3). The 400 m of overlying sediments cover a period of approximately 1 Ma. Preliminary palynological and organic geochemical investigations indicate a number of significant floral and faunal transitions throughout the core and work is in progress to establish if the Cretaceous-Tertiary Boundary exists within the basal section of the core.

Distribution of organic compounds indicate the main sources of organic matter in the post impact sediments are dominated by algal input (Figure 4) with an increasing higher plant contribution up the core, this trend is also observed in the C/N ratios. Carbon isotopic analysis of the bulk organic material show that there are a number of pronounced isotopic excursions in the first 100 m of core above the boundary (Figure 5)

From isomeric distributions of biomarkers, sediments above the impact boundary are still thermally immature (Figure 4).

Figure 1: Location of Boltysh impact crater and estimated range of ejector layer

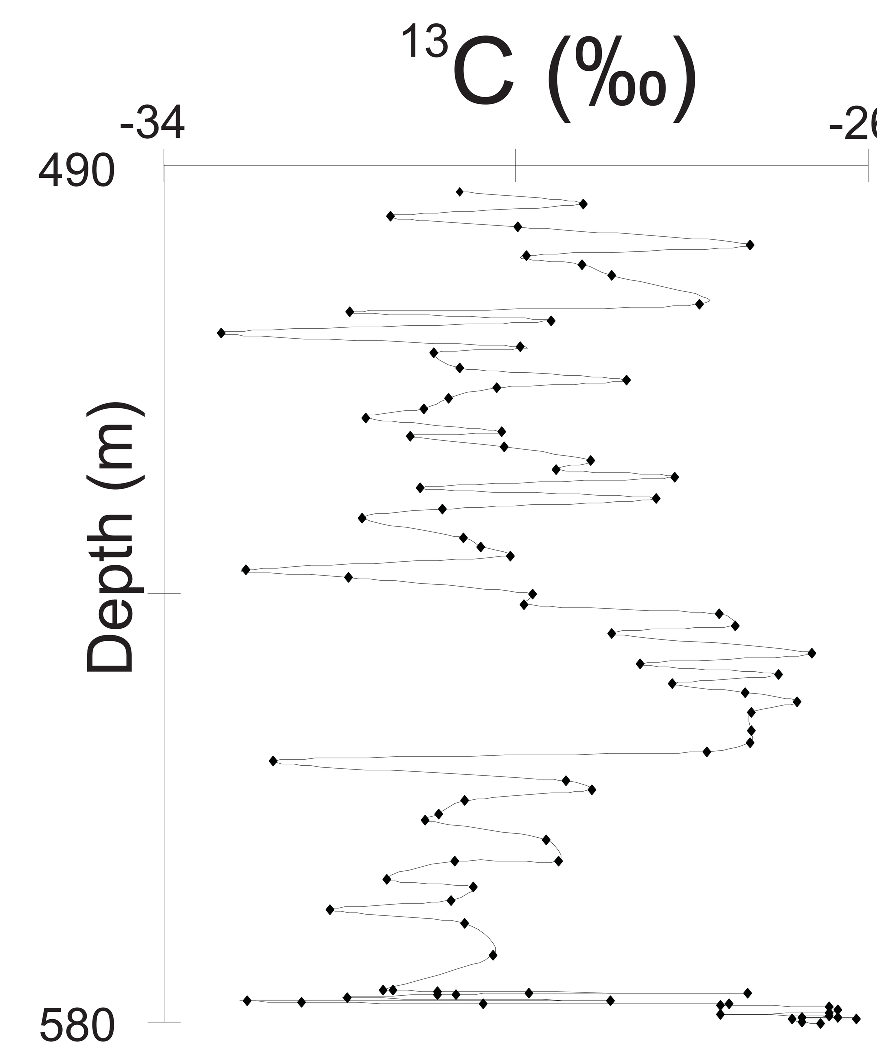

Figure 5: Bulk organic ^{13}C values for crater fill sediments

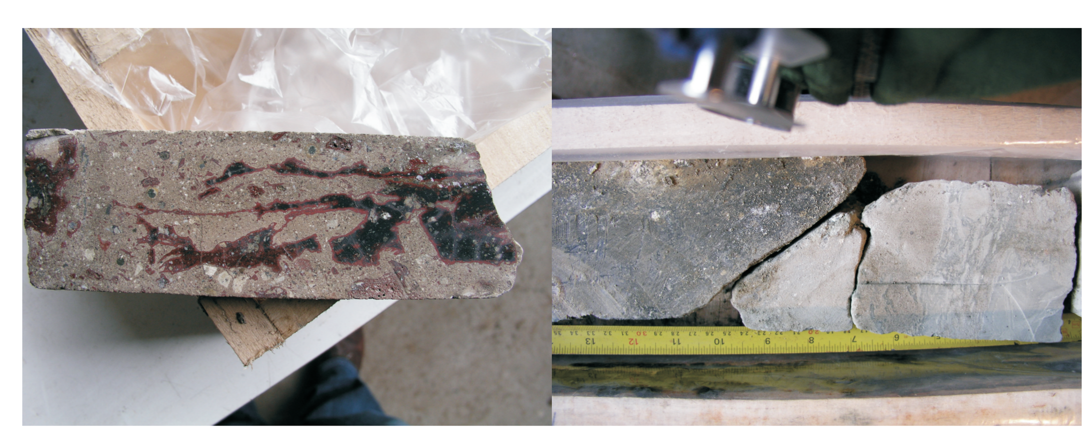

Figure 2 : A) Suevite containing glass veins and B) Boundary between impact breccia (on left) and overlying sediments.

PLANNED WORK

Work is in progress to complete the detailed palynological survey of the core and organic geochemical analyses. These studies will enable us to reconstruct the paleoenvironmental history of the post-impact environment at Boltysh and to examine the subsequent paleoenvironmental record preserved in the crater-fill sediments for a region of North Tethys where paleoenvironmental information is presently scarce.

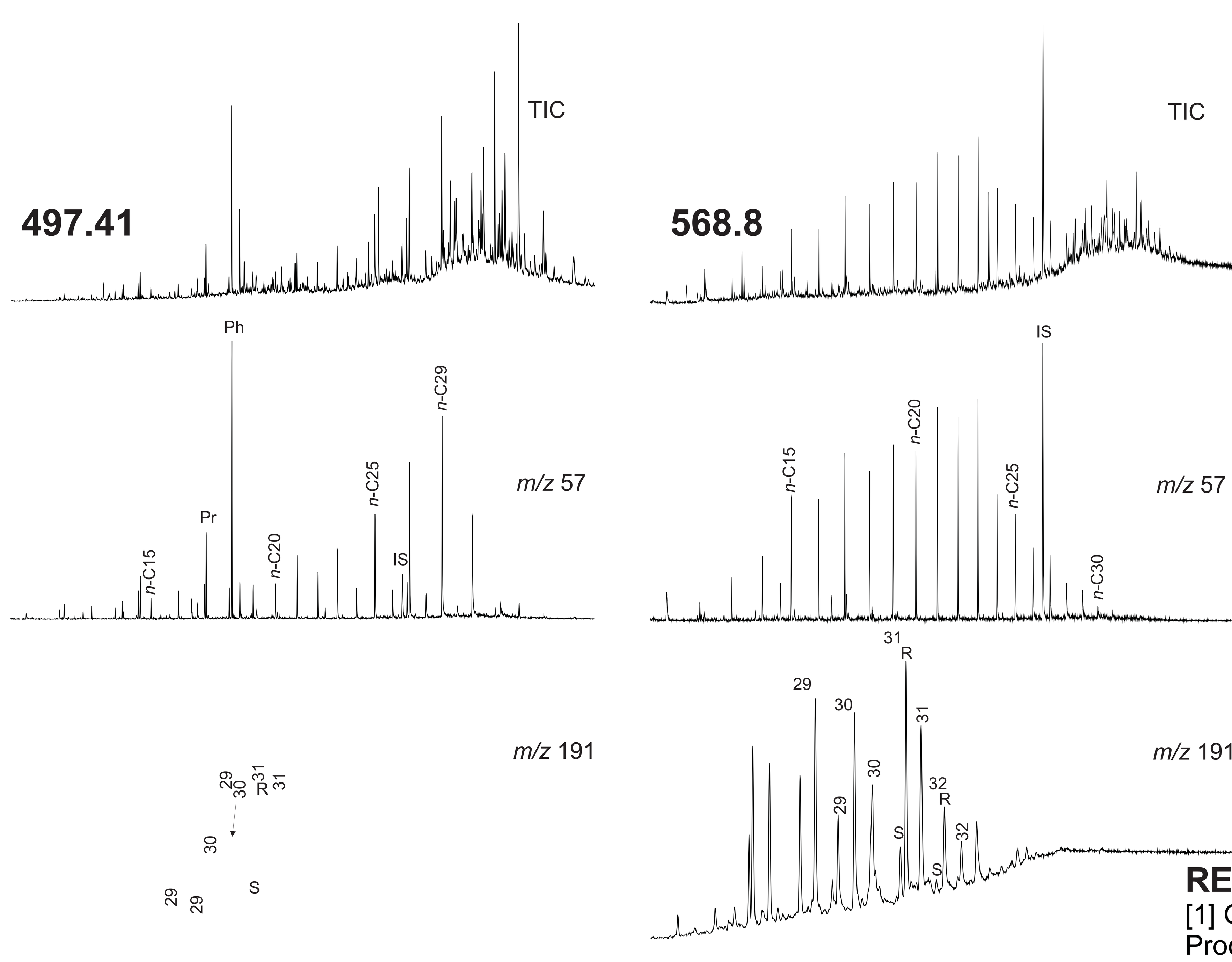

Figure 4: TIC and partial mass chromatograms of sample extracts at 497.41 and 568.6 m depth (84.09 and 12.9 m above the boundary respectively)

REFERENCES

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